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Note on Tubercularia pezizoidea Schwein.

By Hermann Schrenk.

(Plate 218.)

In the "Synopsis Fungorum" (1831)[1] appeared the description of a fungus, collected on poplar logs in New York by Dr. Torrey, to which Schweinitz gave the name *Tubercularia pezizoidea*. The description was as follows: "T. Sporidochiis, fasciculatim confluentibus, maximis, pezizoideis, undulato-plicatis, ex-epidermide prorumpentibus et ad uncialem longitudinem irregulariter confluentibus, pede crasso suffultis, substantia induratocornea, strato sporidifero compacto incarnato purpureo, subnitente, sed superficie subpruinosa. Intus albescunt et ætate subpulverulenta evadunt sporidochia. Talis cupula non confluens diametrum plus quam bilinearam habet et Pezizam margine obtuso, undulato plicato disco refert."

This fungus, apparently common in the northern United States, was reported by Hitchcock[2] as *Tubercularia pezizoidea* Schw. in 1829, previous to the publication of the name by Schweinitz, Hitchcock probably having seen some of the Schweinitz specimens. Somewhat later Sprague[3], in cataloging this form from

1. *L. D. de Schweinitz*—Synopsis Fungorum in America Boreali media degentium. Communicated to Am. Phil. Soc. Philadelphia, 15 Ap. 1831.

2. *E. Hitchcock*—Catalogue of Plants growing within 50 miles of Amherst, Mass. 64. 1829.

3. *C. S. Sprague*—Bost. Soc. Nat. Hist. **6**: 319. 1858.

Eastern Massachusetts as *Tubercularia pezizoidea* Schw. makes the following note: "This is not a true *Tubercularia*, but is an anomalous and probably immature form of some high order. It is found, however, all over the United States in precisely the same condition, specimens from Lake Superior and Massachusetts do not differ at all." In 1875 in Grevillea,[4] there is a description of a *Hypocrea*, where it is stated that it and the *Tubercularia pezizoidea* of Schweinitz are identical. This was named *Hypocrea Richardsoni* Berk. & Mont. I have been unable to find any note as to Montagne's connection with this species, the paper in Grevillea being by Berkeley, and the earliest one in which the name *Hypocrea Richardsoni* occurs, as far as I have been able to ascertain.

Since then the fungus has been reported under one of these two names by various writers. Cooke[5], and Paoletti[6] give it as *Tubercularia pezizoidea*. Frost[7] uses the name *Hypocrea Richardsoni* in 1869, six years previous to its publication (evidently a manuscript name.) It is mentioned as this furthermore by Tuckerman and Frost[8], Fowler[9], Day[10], Arthur[11], Cobb[12], Kelsey[13], Farlow[14], Peck[15] and Cockerell[16].

In order to determine whether this fungus is a *Hypocrea* or a *Tubercularia*, I examined specimens from various sources. I was

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4. *M. J. Berkeley*—Notices of North American Fungi. Grev. 4: 14. 1875–76.
5. *M. C. Cooke*—Hyphomycetous Fungi of U. S. Bull. Buffalo Soc. 3: 192. 1877.
6. *Giulio Paoletti*—Revisione del Genere *Tubercularia*. Atti Soc. Ven. Trent. Sci. Nat. 11: fas. 1, Padova. 1888.
7. *C. C. Frost*—Enumeration of New England Fungi. Proc. Bost. Soc. Nat. Hist. 12: 80. 1869.
8. *E. Tuckerman and C. A. Frost*—Cat. of Plants growing without Cultivation within 30 miles of Amherst College. 1875.
9. *James Fowler*—List of New Brunswick Plants. Ann. Rep. Sec. Agr. Prov. N. B. for 1878.
10. *David F. Day*—Cat. of Plants about Buffalo, 161. 1883.
11. *J. C. Arthur*—Report of Botanical Work in Minnesota for 1886. 33.
12. *W. A. Cobb*—A List of Plants found growing wild within 30 miles of Amherst, Mass. 1887.
13. *F. D. Kelsey*—Notes on the Fungi of Helena, Mont. Journ. Myc. 5: 81. 1889.
14. *W. G. Farlow*—Cryptogamic Flora of White Mts. Appalachia 3: 247.
15. *C. H. Peck*—22d N. Y. State Report, 97.
16. *T. D. A. Cockerell*—Notes on Flora of high altitudes in Custer Co., Colorado. Bull. Torr. Bot. Club, 18: 173. 1891.

fortunate in being able to see some of the original Schweinitz specimens and to recognize that they agreed in every way with specimens of Berkeley's *Hypocrea Richardsoni*. (In Herb. Curtis, Russell, Mass. 5870.) Although the external appearance is that of a *Tubercularia*, yet the structure is in no way that of a *Tubercularia*. As to its being a *Hypocrea*, there are to be sure structures which by many have been mistaken for asci and their spores, but which, as will be seen, are of an entirely different nature.

The fungus is scattered over the branches of poplars in tubercular, purplish-red masses, breaking through the epidermis at an early stage. It is attached to the substratum at the centre, is disc-shaped and convex above when young, becoming more or less wrinkled when old. On sectioning a single mass it will be found to consist of a loosely woven mycelium on the inside, the hyphæ of which gradually become parallel, forming a cortex of parallel hyphæ. Into this layer there extend large club-shaped bodies filled with larger and smaller oil-globules ("c" fig. 4.) These bodies are in most cases perfectly club-shaped, but some very irregular forms are met with, branching or swelling at the apex into bodies resembling sporidia. By various authors these bodies have been taken for asci and described as such, but it is evident from their vague and uncertain descriptions of spores that they were not sure of having seen any. More recent writers have always reported the fungus as sterile. (Ellis[17], Peck[18], etc.).

On closely examining the tips of the parallel hyphæ, some of them were found projecting beyond the others, slightly swollen and provided with four distinct sterigmata and spores. In order to see these distinctly, it was found very advantageous to treat the sections for several minutes with potash and employ a high magnification. The fertile basidia are not very numerous, and are difficult to distinguish from the paraphyses, as I would call the parallel hyphæ. The sterigmata are short and have at their tip fuliginous elliptical basidiospores. There is a possibility that the basidia at first have conidia, in fact some of the sterile basidia were constricted at the top as if about to bear a conidium. As to the clavate bodies there is some question concerning their func-

17. *J. B. Ellis and B. M. Everhart*—Journ. Myc. 2 : 62. 1886.
18. *C. H. Peck*—24th N. Y. State Mus. Rep. 103.

tion. They differ from the cystidia of other Hymenomycetes in not being at a level with the basidia in the hymenium, their position in this respect being very constant. Whether or not they function as food receptacles, as might be supposed from their oily contents, it is difficult to say.

An examination of various specimens of *Hypocrea Richardsoni* showed the basidia and sterigmata in most cases. The ones in Ellis, N. A. F., 1329, were particularly good. The Schweinitz specimens of *Tubercularia pezizoidea* had a large number of clavate bodies and sterile basidia. Specimens collected by Dr. Thaxter at Waverly, Mass., and others from Shelburne, N. H., collected by myself this spring, showed the basidia and their spores perfectly.

From all this it appears that the fungus is neither a *Tubercularia* nor a *Hypocrea*, but one of Basidiomycetes and more specifically one of the Hymenomycetes. The basidia are in a hymenium which is perfectly smooth, a character which would place this form among the Thelephoreæ. The absence of setæ, the superior hymenium, the approximately flat and sessile sporophore includes it in my opinion in the genus *Corticium*. The plant would then have to take the name *Corticium pezizoideum* (Schw.) and be characterized as follows:

Scattered or gregarious, purplish-red, breaking through the epidermis, finally centrally attached, margin free, discoid, smooth when young, becoming more or less wrinkled when older. Hymenium smooth; basidia 5.5 μ wide with slightly allantoid fuscous basidiospores 5–7 μ + 1½ μ. Large cystidia-like bodies very numerous, extending into the hymenial layer, generally with numerous oil-globules.

Growing on poplar logs in the colder portions of North America, from New England westward to Colorado and northward.

I would thank Dr. W. G. Farlow for the use of specimens and literature and for his interest and aid offered me in my work.

Description of Plate 218.

FIG. 1. *Corticium pezizoideum* (Schw.) Schrenk. The older ones are wrinkled.

FIG. 2. Section of a young *Corticium*, rupturing the epidermis.

FIG. 3. Section of a mature *Corticium* (magnified), showing the hymenium and the clavate bodies distributed through it.

FIG. 4. A portion of the hymenium more highly magnified; "b," basidia and spores; "c," clavate bodies; "p," paraphyses.

FIG. 5. Irregular forms of the clavate bodies containing oilglobules.
FIG. 6. Basidia with sterigmata and spores (highly magnified).
FIG. 7. Basidiospores.

Contribution to the Lichens of Maine.--I.

BY F. L. HARVEY.

The following list embraces lichens from Maine collected by the Rev. Joseph Blake and found in the Blake Herbarium of the Maine State College, together with species noticed about Orono by the writer, and a few species recorded from Maine in Tuckerman's North American Lichens.

The list includes all the species known by the writer to have been published from the State. No personal efforts have been made to collect these neglected forms beyond what was needed for class work, hence the list from Orono and other parts of the State is far from exhaustive.

Miss Cummings has collected quite extensively during the past season in Aroostook Co., and we understand has detected quite a large number of interesting forms that will swell the State list. The lichens in the Blake Herbarium were largely collected from thirty to forty years ago, those from Mt. Ktaadn bearing date of July 4, 1856. Mr. Blake's correspondence shows that probably all his specimens were determined by Tuckerman. The specimens have withstood the ravages of time much better than the names have the criticisms of systematists.

The synonymy has presented some knotty problems, which we trust have been correctly solved. The modern names only have been given in the list. We desire to acknowledge our indebtedness to Miss Clara E. Cummings for professional courtesies. We would be pleased to correspond with all who have collected lichens or other Cryptogams in Maine, looking toward a catalogue of the Cryptogams of the State. In listing the species we have followed the sequence adopted in Tuckerman's "Genera Lichenum."

Tribe I.—Parmeliacei.

FAM. I.—USNEEI.

1. *Ramalina calacaris canaliculata* Fr. On trees, common. Me. (Blake); Orono (Harvey).

2. *R. pusilla* (Prev.). On trees. (Tuckerm. N. A. Lich. 1. 26.) On trees, Me. (Tuckerman).
3. *Cetraria Islandica* (L.) Ach. On ground, common. Mt. Ktaadn (Blake); Orono (Harvey).
4. *C. cucullata* (Bell) Ach. On earth. Mt. Ktaadn (Blake).
5. *C. nivalis* (L.) Ach. Mt. Ktaadn (Blake).
6. *C. Fahlunensis* (L.) Schær. Mt. Ktaadn (Blake).
7. *C. ciliaris* Ach. On trees and rails. N. Yarmouth (Blake); Orono (Harvey).
8. *C. lacunosa* Ach. Mt. Ktaadn (Blake).
9. *Evernia prunastri* (L) Ach. On rails, Me. (Blake); Orono (Harvey).
10. *Usnea barbata* (L.) Fr. Type.
11. *Usnea barbata florida* Fr. Cumberland (Blake); Orono (Harvey).
12. *Usnea barbata hirta* Fr. Cumberland (Blake); Orono (Harvey).
13. *Usnea barbata serotina* Fr. Cumberland (Blake); Orono (Harvey).
14. *Usnea barbata dasypoda* Fr. Cumberland (Blake); Orono (Harvey).
15. *Usnea barbata plicata* Fr. Cumberland (Blake); Orono (Harvey).
16. *U. longissima* Ach. On spruce trees. Greenfield (Harvey).
17. *Alectoria jubata chalybeiformis* Ach. On rails. Cumberland (Blake); Orono.

FAM. 2.—PARMELIEI.

18. *Theloschistes parietinus* (L.) Norm. On stones. Common. Wells (Blake); Orono (Harvey).
19. *T. concolor* (Dicks.) Cumberland (Blake).
20. *Parmelia perlata* (L.) Ach. On stones. Common. Cumberland (Blake); Orono (Harvey).
21. *P. tiliacea* (Hoffm.) Flœrk. Trees and rocks. Cumberland (Blake); Orono Harvey).
22. *P. saxatilis* (L.) Fr. Wells (Blake); Orono (Harvey).
23. *P. physodes* (L.) Ach. Saco (Blake); Orono (Harvey).
24. *P. colpodes* (Ach.) Nyl.; Orono (Harvey).
25. *P. olivacea* (L.) Ach. Common. Mt. Ktaadn (Blake); Orono (Harvey).
26. *P. olivacea sorediata* (Ach.) Nyl. Mt. Ktaadn (Blake). In Blake's Herb. as *P. dendritica* Nyl.
27. *P. stygia* (L.) Ach. Mt. Ktaadn (Blake).
28. *P. caperata* (L.) Ach. Trunks and stones. Wells (Blake); Orono (Harvey).
29. *P. conspersa* (Ehrh.) Ach. Rocks and stones. Cumberland (Blake); Orono (Harvey).
30. *P. centrifuga* (L.) Ach. Mt. Ktaadn (Blake); Mt. Desert (Tuckerm. N. A. Lichens, 1. 65).
31. *P. incurva* (Pers.) Fr. Mt. Desert (Tuckerm. N. A. Lichens, 1. 65).
32. *Physcia speciosa* (Wulf. Ach.) Nyl. On rocks. Wells (Blake).
33. *P. stellaris* (L.) On apple trees and poplar. Wells (Blake).

FAM. 3.—UMBILICARIEI.

34. *Umbilicaria proboscidea* (L.) Stenh. Alpine rocks. Mt. Ktaadn (Blake).
35. *U. polyphylla* (L.) Hoffm. Mt. Desert (Tuckerm. N. A. Lich. 1. 85).
36. *U. flocculosa* Hoffm. Mt. Desert (Tuckerm. N. A. Lich. 1. 85).
37. *U. hyperborea* Hoffm. Mt. Ktaadn (Blake).

38. *U. erosa* (Web.) Hoffm. Mt. Ktaadn (Blake).
39. *U. Muhlenbergii* (Ach.) Tuckerm. Cumberland (Blake).
40. *U. Dillenii* Tuckerm. Harrison (Blake); Searsport (Black).
41. *U. pustulata* (L.) Hoffm. Rocks. Cumberland (Blake).

FAM. 4.—PELTIGERI.

42. *Sticta amplissema* (Scop.) Mass. Trees. Cumberland (Blake); Orono (Harvey).
43. *S. herbacea* (Huds.) Ach. Cumberland (Blake); Orono (Harvey).
44. *S. pulmonaria* (L.) Ach. Common on trees. Cumberland (Blake); Orono (Harvey).
45. *S. crocata* (L.) Ach. Cumberland (Blake).
46. *Nephroma tomentosum* (Hoffm.) Kœrb. Harrison (Blake).
47. *N. Helveticum* Ach. N. Bridgton (Blake).
48. *N. laevigatum* Ach. Harrison (Blake).
49. *Petigera apthosa* (L.) Hoffm. Harrison (Blake); Orono (Harvey).
50. *P. horizontalis* (L.) Hoffm. Ground on moss. Cumberland (Blake); Orono (Harvey).
51. *P. polydactyla* (Neck.) Hoffm. Harrison and Mt. Ktaadn (Blake); Orono (Harvey).
52. *P. scuta* (Dicks.) Leight. N. Bridgton (Blake).

FAM. 5.—PANNARIEI.

53. *Pannaria granitina* (Sommerf.) Maine (Willey). (Tuck. N. A. Lich. I. 118.)
54. *P. plumbea* (Lightf.) Delis. Mt. Desert (Tuckerman N. A. Lich. I. 124).

FAM. 6.—COLLEMEI.

55. *Collema nigrescens* (Huds.) Ach. Harrison (Blake).
56. *Leptogium tremelloides* (L. f.) Fr. Harrison (Blake).
57. *L. chloromelum* (Sw.) Nyl. Maine (Blake).
58. *L. Burgessii* (Lightf.) Mont. Maine (Oakes). (Tuck. N. A. Lich. I. 165).
59. *L. myochroum saturninum* Schær. Harrison (Blake).

FAM. 7.—LECANOREI.

60. *Placodium elegans* (Link) DC. On rocks. Wells (Blake).
61. *P. microphyllinum* Tuckerm. On old fences. Orono (Harvey).
62. *P. cerinum* (Hedw.) Næg. & Hepp. On rails, common. Me. (Blake); Orono (Harvey).
63. *P. ferrugineum discolor* Willey. Mt. Desert (Tuckerman). (Tuckerm. N. A. Lich. I. 177.)
64. *P. vitellinum* (Ehrh.) Næg. & Hepp. Dead wood. Cumberland (Blake).
65. *Lecanora pallida* (Schreb.) Schær. On beach trees. Wells (Blake); Orono (Harvey).
66. *L. subfusca distans* Ach. On trees and dead wood. Wells (Blake); Orono (Harvey).
67. *L. varia* (Ehrh.) Nyl. Harrison (Blake).
68. *L. tartarea* (L.) Ach. On rocks. Harrison (Blake).
69. *L. molybdina microcyclos* Wahl. (Tuckerm. N. A. Lich. I. 201.)

70. *Pertusaria velata* (Turn.) Nyl. Cumberland (Blake).
71. *P. multipunctata* (Turn.) Nyl. On yellow birch, with other Maine specimens, but not labeled (Blake).
72. *P. communis* D.C. In Blake's Herb. as *P. pertusa* Ach. No locality; but with Maine specimens (Blake).
73. *P. Wulfenii* D.C. Cumberland (Blake).
74. *Conotrema urceolatum* (Ach.) Tuckerm. In Blake's Herb. with Maine specimens, without locality. Orono (Harvey).

Tribe II.—Lecideacei.

Fam. 1.—Cladoniei.

75. *Stereocaulon coralloides* Fr. Mt. Ktaadn (Blake).
76. *S. paschale* (L.) Fr. Mt. Ktaadn. Cumberland (Blake); Orono (Harvey).
77. *S. tomentosum* (Fr.) Th. Fr. On ground. Cumberland (Blake); Orono (Harvey).
78. *S. pileatum* Ach. Maine (Willey). (Tuckerm. N. A. Lich. 1. 233.)
79. *Cladonia pyxidata* (L.) Fr. On ground. Cumberland (Blake); Orono (Harvey).
80. *C. gracilis* (L.) Nyl. Type. Cumberland (Blake).
81. *C. gracilis verticillata* Fr. Mt. Ktaadn (Blake).
82. *C. gracilis cervicornis* Flœrk. North Bridgton (Blake).
83. *C. gracilis hybrida* Schær. Orono (Harvey).
84. *C. gracilis elongata* Fr. Maine (Willey). (Tuck. N. A. Lich. 1. 243); Orono (Harvey).
85. *C. turgida* (Ehrh.) Hoffm. On ground. Cumberland and Wells (Blake).
86. *C. squamosa* Hoffm. Mt. Ktaadn (Blake).
87. *C. squamosa furcata* Fr. Mt. Ktaadn (Blake).
88. *C. furcata crispata* Fl. Cumberland (Blake).
89. *C. furcata subulata* Fl. Mt. Ktaadn (Blake).
90. *C. rangiferina* (L.) Hoffm. Cumberland (Blake); Orono (Harvey).
91. *C. rangiferina sylvatica* L. Wells (Blake); Orono (Harvey).
92. *C. rangiferina alpestris* L. Mt. Ktaadn (Blake); Orono (Harvey).
93. *C. amaurocrea* (Fl.) Schær. Mt. Ktaadn (Blake); Holden (C. F. Dole).
94. *C. uncialis* (L.) Fr. Cumberland (Blake).
95. *C. uncialis adunca* Wells (Blake).
96. *C. Boryi* Tuckerm. Wells (Blake).
97. *C. cornucopioides* (L.) Fr. Mt. Ktaadn. Cumberland (Blake); Orono (Harvey).
98. *C. bellidiflora* (Ach.) Schær. Wells (Blake).
99. *C. macilenta* (Ehrh.) Hoffm. Specimens named *C. Flœrkiana* Fr. from Cumberland are in the Blake Herbarium, but probably should be referred to the above.
100. *C. cristatalla* Tuckerm. Wells (Blake); Orono (Harvey).

Fam. 3.—Lecideei.

101. *Bæomyces roseus* Pers. Common. Orono.
102. *Biatora ostreata* (Hoffm.) Fr. Mt. Desert (Willey). (Tuck. N. A. Lich. 2. 14.)

103. *B. coarctata* (Sm. Nyl.) Maine (Willey). (Tuck. N. A. Lich. 2. 15.)
104. *B. vernalis* (L.) Fr. Harrison (Blake).
105. *B. sanguino-atra* (Fr.) Tuckerm. Harrison (Blake). A specimen from Mt. Ktaadn named *Lecidea sanguinaria* Ach. seems to be referable to the above.
106. *B. carnulenta* Tuckerm. Maine (Willey). (Tuck. N. A. Lich. 2. 23.)
107. *Lecidea contigua* Fr. Mt. Ktaadn (Blake).
108. *Buellia parasema* (Ach.) Th. Fr. Orono (Harvey).
109. *B. Œderi* (Ach.) Br. & Rostr. Coast of Maine (Tuckerm.). (Tuck. N. A. Lich. 2. 102.)
110. *B. geographica* (L.) Tuck. Coast of Maine (Tuckerm.). (Tuck. N. A. Lich. 2. 103.)

Tribe III.—Graphidacei.

FAM. 1.—XYLOGRAPHEI.

111. *Xylographa parallela* Nyl. Maine (Pringle). (Tuck. N. A. Lich. 2. 112.)
112. *X. disseminata* Willey. Mt. Desert (Willey). (Tuck. N. A. Lich. 2. 112.)
113. *X. opgraphella* Nyl. Maine (Tuckerm.). (Tuck. N. A. Lich. 2. 113.)

FAM. 3.—OPEGRAPHEI.

114. *Graphis scripta* (L.) Ach. Cumberland (Blake); Orono (Harvey).

Tribe IV.—Caliciacei.

FAM. 1.—SPHÆROPHOREI.

115. *Sphærophorus fragilis* (L.) Pers. Mt. Ktaadn (Blake).

Lichens new to North America.

BY JOHN W. ECKFELDT.

During the past few years I have had under examination numerous collections of Lichens from all portions of North America, and among them quite a notable number have proven to be new. Many of these have been submitted to the kind observation of Drs. Nylander and Muller, and I have to thank them for the determinations. Not wishing to burden them with too much material from our country, I herewith submit the following paper on some noteworthy species.

PANNARIA APPLANATA n. sp.

Thallus squamulose, more or less irregularly lobulate, the divisions at the border cut-crenate, flat, quite closely adnate to the substrata; the centre sparsely granulose, pale olivaceous or a rusty yellow. Hypothallus showing in distinct patches and of a paler color. Apothecia scattered, rounded and elevated with a

receding margin, simple and slightly paler than the disk. Spores small, ellipsoid or ovoid, hyaline, entire, $\frac{8 \times 9}{2\frac{1}{2} \times 3}$ mic.

Occurring on various barks in San Luis Potosi, Mexico, 1887. Mr. C. G. Pringle, No. 155.

THELOTREMA CARNEA n. sp.

Thallus orbicular, becoming irregularly diffused over large areas, thin-membranaceous, minutely granulose, soft, frequently traversed by narrow waving anastomosing black lines, from pale carnate to rosy pink. Apothecia small to very minute, sunken in the thalline layer, open, the interior exciple quite distinct from the outer border, which is erect with a rounded subcrenulate margin. Disk black, slightly roughened, the exterior exciple thickened. Spores oblong, triseptate $\frac{12 \times 14}{3 \times 3\frac{1}{2}}$ mic.

This striking species occurs on trunks of *Celtis occidentalis* in the low country near St. Martinsville, Louisiana. A. B. Langlois.

BIATORA (PATELLARIA) FLOCULESCENS n. sp.

Thallus more or less mixed, made up principally of small lobulate or crustaceous scales, roughish and covered by an extremely fine flocculent pubescence, imparting to the surface a soft appearance, ashy brown to darker. Apothecia quite flat, but becoming convex. Disk chestnut brown, margin simple, entire, receding in older stages of growth, paler within. Spores simple, ovoid, hyaline, entire $\frac{9 \times 10}{8 \times 6}$ mic.

On bark near Monterey, Mexico. Mr. C. G. Pringle, 1887, no. 253.

BIATORA (PATELLARIA) DISPERSA n. sp.

Thallus smooth, uneven, finely granulate, limited by a fine line and dispersed evenly over the bark area, ash color and becoming paler at the border. Apothecia adnate, sessile, very flat; disk smooth and surrounded by a waving, irregular, paler, true margin which is enclosed by a thicker, light thalline ring, reddish brown to black, entire. Spores hyaline, broadly ovoid $\frac{9 \times 12}{6 \times 7}$ mic.

On barks, San Luis Potosi, Mexico. Mr. C. G. Pringle, 1887.

BIATORA SUTURALIS n. sp.

Thallus slightly thickened, crustaceous and becoming finely granulose, broken up into areola-like divisions, but not squamose, interspersed throughout by distinct, prominent, waving suture-like, black, diffuse lines, from pale ashy to cream color.

Apothecia flattish, scattered at first, a little concave, but afterwards somewhat convex, margin soon disappearing, disk brown. Spores acicular, hyaline $\frac{30\times40}{3\times4}$ mic.

On barks, San Luis Potosi, Mexico. Mr. C. G. Pringle, 1888, no. 183.

ARTHONIA DISTINCTA n. sp.

Thallus thin, smooth, white, indeterminate, slightly mealy. Apothecia very minute, round-lobed, and disposed to become radiate in small clusters, slightly sunken or in part even with the thallus; disk black, with a rough or uneven surface. Spores dark, 3–4-locular, broadly ovoid $\frac{15\times18}{7\times8}$ mic.

On smooth barks, San Luis Potosi, Mexico. Mr. C. G. Pringle, 1888. The similarity of this plant to *A. radiata* is marked, but certain characters determine it to be distinct.

TRYPETHELIUM PRINGLEI n. sp.

Thallus thin, smooth or generally finely tuberculate, tubercles rounded, elevated, diffused, from pale yellow to white; stromas prominent, round to oblong and irregularly protruding, paler than the surrounding crust. Osteoles minute, rounded, very prominent, dark brown. Spores broadly ellipsoid, quadriseptate $\frac{15\times20}{4\times6}$ mic.

A well marked species contrasting strikingly with *T. oligocarpum* Mull. Lich. Australia. Occurs on the trunks of trees near San Luis Potosi, Mexico. Mr. C. G. Pringle, no. 226.

TRYPETHELIUM SCITULENS n. sp.

Thallus slightly transversly wrinkled and smoothish, of an opaque, olive green color. Stromas prominent, rounded, becoming at length oblong, solitary or generally confluent, and more or less of the same color as the thallus. Osteoles numerous, very minute and closely approximate, mostly brown. Spores oblong ellipsoid, 10-septate $\frac{27\times33}{10\times12}$ mic.

On the trunks of various trees near San Luis Potosi, Mexico. Mr. C. G. Pringle, no. 200.

PYRENULA PAPULIFORMIS n. sp.

Thallus extremely thin, evanescent, diffuse, pale ash color, and often differing but slightly from the normal shade of the bark. Apothecia somewhat conoidal, black with a round spread-

ing perithecium; osteole poreiform, innate. Epithecium pale, whitish. Hymenium black. Spores ellipsoid, elongated, hyaline, bilocular $\frac{14\times16}{4\times6}$ mic.

On trunks with smooth barks, San Luis Potosi, Mexico. Mr. C. G. Pringle. Not unlike *P. majuscula* Nyl. of the Hawaiian Islands in general appearance.

Notes on the Chromatophores of Astrophyllum sylvaticum Lindb. (Mnium cuspidatum Hedw.), and of some other Plants.

By Alfred C. Stokes.

Among the commonest mosses in my locality is the one usually referred to as *Mnium cuspidatum* Hedw., my specimens having been identified for me by Dr. G. N. Best, of Rosemont, N. J. The plant is always so attractive in appearance at almost any season, that for several years I have been in the habit of collecting it in the autumn, and of keeping it all winter under an inverted glass on my table, where in the diffused light of a warm room it will grow and flourish, and, as I have learned, supply the microscopist with several important objects for investigation, asking in return only that it shall be abundantly furnished with the moisture which it must have or die. I know that it has long been a favorite object of study with microscopical botanists, but I have not been able to learn that the observations which I have had the pleasure of making over it have been anticipated.

But the leaf-cells of *Astrophyllum sylvaticum* are so transparent, especially in the adult and the young conditions, that microscopical examination may be made of them in their living state. In these young and in the mature, but not old cells, the chromatophores (chloroplasts or chlorophyll-bodies) are so few and so conveniently scattered over the upper and the lower cell-surfaces that they may be studied with some ease and the protoplasmic cell-contents examined with as great comfort while the whole leaf is living in a 4 per cent. solution of sugar, in which its structure is apparently unaltered, and where for a time its functions are not vitiated. It is especially to the structure of the chloroplasts in these and in some other leaves that this paper is devoted.

There has been considerable discussion as well as considerable divergence of opinion in regard to the structure of the chlorophyll-grains. What I have to relate refers solely to what I have seen, or think that I have seen, in the chromatophores of the plants to be mentioned.

Any countryman is entitled to an opinion on all subjects, provided that the tools which he uses in his investigations are as good as can be had, that he uses them intelligently and that he describes his observations as he thinks he has seen the objects, holding his imagination in check, and always bearing in mind that he is human and therefore "prone to err." The tools in this special case are the ¼ and the ⅛ inch objectives, both by Zeiss, and both apochromatic; Spencer's homogeneous-immersion $\frac{1}{16}$, N. A. 1.35; Reichert's semi-apochromatic, oil-immersion $\frac{1}{12}$, N. A. 1.40; Gundlach's homogeneous-immersion $\frac{1}{16}$, N. A. 1.22; an achromatic condenser; Powell and Lealand's 2-inch, and Zeiss' 8 and 27 eye-pieces, all compensating. The conditions are that the leaf shall be studied in the 4 per cent. sugar-solution with no preparation, except in some cases, the free-hand sectioning of the object and its immediate examination.

In reference to the structure of chloroplasts, F. Schwartz says* that they are formed of fibrillæ, which are arranged in a network, yet lie side by side attached to one another by what he calls metaxin. Such structure is not visible in the chromatophores of *Astrophyllum sylvaticum* nor in those of any other plant which I have examined; and likewise A. Meyer says† that he has failed to see the fibrillæ and does not hesitate to add that Schwartz's observations are incorrect. Schimper, in an extended treatise on the subject says‡ that the simplest chromatophores consist of a colorless protoplasmic substance without any visible internal structure or contents, and that this is sometimes the case during the whole of their existence, as with most leucoplasts.

Structure is so plainly visible on the external surfaces of the chloroplast of *Astrophyllum sylvaticum* that I confess to consider-

* Cohn's Beitr z. Biol. Pflanzen, **5**: 1–224.

† Bot. Ztg. **46**: 636.

‡ Pringsheim's Jahrb. f. wiss. Bot. **16**: 1–247. Cf. Journ. Roy. Micros. Soc. (II.) **6**: 640.

able regret when I failed in my efforts to section the chlorophyll-grains, or rather to assure myself that they had been sectioned after the effort to cut them had been made. Yet optical sections obtained with the best objectives of wide angle have always so plainly showed the structure from one surface to the other that I must believe that what appears so conspicuously on the outside is likewise continued throughout the entire chromatophore. I have not yet seen a chloroplast from this special moss, nor from any other plant in which they are externally structured, in which I have failed to observe the markings until the chromatophore became disintegrated; in sections where the chlorophyll-grains were presumably cut, homogeneous, internal substance has been equally invisible.

That the pitted or spongy aspect so apparent on the surface of the chloroplasts of *Astrophyllum* is continued within the internal substance is demonstrable only by means of the optical sections referred to, since the chlorophyll-grains are so loosely attached to the cell-wall, never coming into actual contact with it, but being imbedded in the threads of protoplasm which radiate through the cell, that they are forced out of the section by the pressure of the knife, and are either not positively cut or are lost. That the entire chromatophore is a chlorophyll-bearing, spongy body cannot, I think, be doubted, after a careful study with good objectives.

The surface-structure referred to, covers the entire chloroplast with an irregularly disposed series of depressions of unequal size and shape. These depressions are surrounded or produced by narrow elevations of the chromatophore-substance, the green coloring matter being as conspicuous in each of the delicate, ridge-like elevations as it is in the general body-substance of the chloroplast itself. When the chlorophyll-grain is examined in optical section, at irregular intervals around the entire margin of the body there come into view the edges of the ridge-like elevations which form the boundaries of the pits, and these appear as exceedingly delicate, green bars projecting from the body. The general appearance, when the chlorophyll-body is examined in this way, is remotely like that of the endocarp of certain stone-fruits, the surface of a peach-pit, for instance, the depressions on the surface of the peach-stone of course being even less regularly disposed and

more shallow than are those of the chloroplast. If an optical section of the peach endocarp could be obtained, the ridges which surround the depressions would, to a certain extent, produce the delicate, bar-like projections as on the margins of the chloroplasts.

My attempts to make drawings of these surface-appearances have failed, although I have had the assistance of beautiful photo-micrographs prepared for me by Dr. H. G. Piffard, of New York, a most accomplished photo-micrographer. The structure is so delicate and so minute that even the photo-micrographs reproduced by the half-tone process would not satisfactorily show it. To see it with the microscope certain conditions are required.

These conditions must be complied with, or the depressions, as I believe them to be, will appear as whitish elevations comparable to the "pearls" on the diatoms when these plants are resolved in the common, that is, the incorrect way. These chromatophore-pearls, like the diatom-pearls in certain cases, become black depressions when the objective is properly focussed. If the apparent elevations on certain parts of certain diatoms are not elevations, then the apparent pearls as seen with a certain focus on the chromatophores are not elevations. In both cases they must be depressions or apertures; otherwise the entire fabric of the secondary structure of the diatoms falls to the ground. If the surface of the chromatophores of *Astrophyllum sylvaticum* is not deeply pitted, and if the entire structure, as seen in optical sections, is not similar to the trabecular formation of the ordinary sponge-skeleton, then those of us that have taken pleasure in the study of the secondary structure of the diatoms have had all our work for nothing, and have been pursuing a phantom. But the existence of this secondary diatom-structure can be demonstated beyond a peradventure.

The lowering of the objective to obtain this "black-dot" resolution gradually brings into view the blackness of the depressions, with the well-defined outlines of the narrow elevations which surround them. The surface of the chromatophore then has a spongy appearance, the black spaces between the irregular network seeming to enter the substance of the chloroplast and there to produce, not a structureless, homogeneous body, but a body of green meshes. Those that have studied the secondary structure of cer-

tain diatoms are familiar with the fact that when the whitish pearls have become black dots by the proper focussing, the edges of the black apertures are not always sharply cut; in fact there is no actual, well-defined edge to the opening, but it is approached by a concave slope, a smooth depression which surrounds the black aperture and leads to it. A homely comparison may be made by thrusting the finger-end into stiff dough, when the resulting depression will show an evenly rounded approach similar to that so readily observable in certain diatoms. A similar condition exists with the depressions on the chromatophores of this moss.

This spongy aspect is not an optical illusion produced by minute granules or other objects within the protoplasm of the cell. The pits and the laterally projecting bars are as conspicuous when the chromatophore has been forcibly extruded and is floating freely in the mounting medium as they are while within the living cell. But the pits are exceedingly shallow; and the narrow ridges are correspondingly low, for I have not been able to measure them with the ordinary micrometer, as the lines made by the diamond are so broad in comparison that they obliterate the bar-like points of the optical section.

That the chromatophores of all plants are trabecular in structure is not yet to be written. In many of our common plants it cannot be demonstrated. In those of *Astrophyllum sylvaticum* there can be no doubt of the trabeculæ.

There has also been some discussion and some disparity of opinion as to the existence of a membrane surrounding the chlorophyll-grain. That all chromatophores are surrounded by a membrane is another assertion which must be put to the test by examining the chlorophyll-grains of all species of plants. Yet Tschirch says* that after experiments on the living cells of *Elodea* (*Anacharis*) and of *Nitella* he is convinced that all chlorophyll-bodies and aleurone-grains are surrounded by an envelope. Repeating this statement in another place† he adds that the coloring matter of two different grains never comes into contact. This is a part of the morphology of the chlorophyll-grains of *Astrophyllum sylvaticum*, and of those in some other plants. Yet in the moss

* Ber. Deutsch. Bot. Gesell. 1: (1883).

† Ib. 2: 265.

the membrane is so exceedingly delicate that it is scarcely possible actually to see it in either the young or in the old chloroplasts. But in those which are undergoing the act of bipartition, this surrounding membrane may at times be examined with some ease, although those fortunate times are not common. In such chromatophores I have seen the membrane, but it becomes especially apparent in those which have been treated with alcohol to bleach the chlorophyll, followed by staining with eosin; fig. 2 representing an optical section of a chlorophyll-grain after such treatment. The two grains are completely divided with the exception of the enveloping membrane which still binds them together. The alcohol has contracted the chromatophore, thus leaving the delicate membrane visible not only about and between the dividing planes, but around the margins of one of the chloroplasts, where it is, as usual, prevented from coming into contact with the body of the grain by the projecting ridges of the surface-structure. On the smaller chromatophore at the left-hand side the membrane is not visible, but in the space separating the two grains it passes as a distinct but exceedingly delicate line, the space being bounded above, as shown in the figure, by a membrane conspicuously depressed in the middle, the lower boundary being as plainly developed.

In fig. 4 is shown a greatly enlarged drawing of the inner ends of the same chloroplasts with the central membrane. The distance from one chlorophyll-grain to the other was about $\frac{1}{13000}$ inch. I have no means of measuring the thickness of the central membrane which separates the chloroplasts, but that membrane is double. This is an exceedingly "fine point" microscopically, and it is here that the "black-dot" resolution again makes itself useful. If the two membranes had been undivided or in actual contact throughout their whole length, the double structure would of course have been invisible. That they were not thus in actual contact the "black-dot" resolution demonstrates by exhibiting the minute black spaces near the upper and the lower extremities, as the chromatophores lie horizontally across the field, the attempt to show this on the greatly enlarged scale in fig. 4 being hardly more than a diagram. In fig. 2 the black, irregular line around the edge of one chromatophore represents the space between the

body of the chlorophyll-grain and the exceedingly delicate membrane, the white projections being the optical sections of the elevated ridges which give the surface its pitted aspect.

In fig. 3 is shown an isolated chromatophore in optical section after treatment with alcohol, by which the grain has shrunk, while a few of the ridges have become rather more prominent, the outline here representing the surrounding membrane, the space between, in the microscopical specimen, being black.

If such a microscopically broad space of darkness is an optical illusion, I am at a loss to account for it on any optical principle with which I am familar. If it is an optical illusion, why the upper margin of the black band should slope from the long projection near the upper right-hand border of the chloroplast to the minutely projecting point at the very apex of that corner, and form concavities between succeeding elevations, becomes even more inexplicable. The enveloping membrane exists.

In addition to the membrane there is a coating of the cell-protoplasm in which each chlorophyll-grain is imbedded. Yet each chloroplast is not entirely isolated from all the others, but is intimately connected by the peculiar arrangement of the protoplasm, which does not entirely fill the cell as it frequently does in similar bodies, but forms a kind of protoplasmic cobweb which loosely fills each cell with its delicate threads. It is these protoplasmic threads which connect together the chromatophores, and it appears to be by their contractions that the position of the green bodies is changed under the influence of the light. A somewhat similar arrangement of the protoplasm has been observed in *Selaginella* by Haberlandt;* a part of one of his drawings is shown in fig. 1.

In *Astrophyllum* these protoplasmic threads are colorless, variously branched and in continuous movement. Every chromatophore in the cell is connected by their means with every other, and the threads themselves radiate from the nucleus.

In fig. 5 are shown several leaf-cells with the protoplasmic threads extending across and around, some being in the central parts of the cell and therefore having no chromatophores in their course. These delicate filaments are continually quivering,

* Flora, 71: 221.

lengthening and shortening, extending themselves in long curves or loops, or contracting into short lines or into little rings. When the leaf-cells are active, the protoplasmic meshes are so numerous and so conspicuous that the entire cell seems to be crowded with the network, within the threads of which float the chromatophores like minute green sponges in a colorless, ever quivering jelly.

Fig. 7 shows the nucleus and its connection with the protoplasmic filaments. Fig. 8 is a transverse vertical section of a leaf to show the chromatophores arranged, as they usually are, near the upper and the lower cell-walls, with the loose network of protoplasmic threads and in the central cell, the nucleus temporarily adhering to the cell-wall. The leaf varies in thickness from $\frac{1}{1250}$ inch at the margin to $\frac{1}{700}$ near the midrib.

Even in the oldest cells the chromatophores are seldom in contact even by their enveloping membranes, and if in a healthy condition there is always a thin layer of protoplasm enclosing and separating each from all the others, and separating each from its apparent contact with the upper and lower cell-walls. When two chromatophores are in apparent contact, careful scrutiny with a high magnifying power will exhibit the black spaces between the peripheral trabeculæ, or the bright, continuous line which is present between two chloroplasts in which the act of bipartition is nearly completed.

Ageratum conyzoides L. cultivated variety *Mexicanum*. In the mesophyll-cells of this plant the chromatophores have a structure similar to that of the chlorophyll-grains of *Astrophyllum sylvaticum*, the larger having more conspicuous trabeculæ, and the surrounding membrane, which exists here also is raised to a shorter distance above the body of the chromatophore on account of the lower elevation of the surface-ridges, or of the network of elevated lines between which the depressions or apertures, as I believe them to be, are placed.

Fig. 6 is a diagram of two chloroplasts from this plant in an advanced stage of bipartition, with the central apertures somewhat exaggerated, as also are the surface depressions represented by the black dots. Attention is asked to the demonstation of the surrounding membrane where it extends from one chromatophore to

the other, and is apparently continuous with the external edge of the dark space which defines and separates the optical sections of the projecting ridges.

Mesembryanthemum crystallinum. (Cultivated.) The chromatophores here seem to have a spongy structure similar to that of the chlorophyll-grains of the two plants previously mentioned, but they are so sensitive to adverse influences that, although the trabecular appearance is conspicuous and distinct, it may possibly be produced by another cause. The 4 per cent. solution of sugar sometimes distorts the chloroplasts, and disintegrates them speedily; water often acts even more quickly, and when they are forced out of the cell and examined in the cell-sap, the changes are almost as rapid and disastrous to their integrity of form and of structure. Yet, although necessarily examined in such unpropitious surroundings, they seem to possess the pitted surface and the delicate enveloping membrane.

Heliotropium Peruvianum L. (Cultivated.) The chromatophores are here prominently trabecular, or spongy in structure. An enveloping membrane can be demonstrated at the periphery of an optical section.

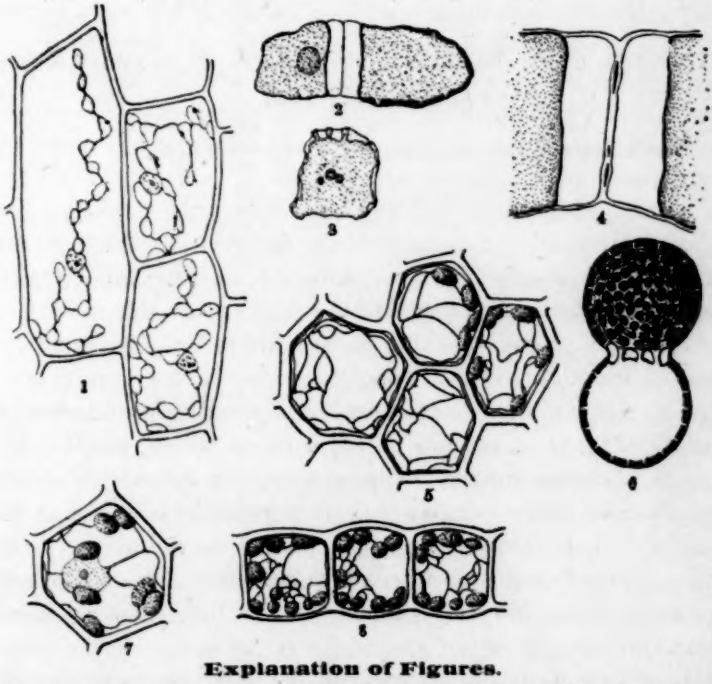
Begonia sempervirens. (Cultivated.) Here the chlorophyll-grains are large and the reticulated structure is prominently developed. At this writing I have not seen the chloroplasts of any plant so conspicuously pitted, and, as I am convinced, so plainly cancellated in structure throughout the entire chromatophore. It is not a difficult task practically to cut successive optical sections from the upper surface of the chloropast to the lower, and in these circumstances, with these special objects, the cancellous structure extends through the whole body and is not mere surface pitting. These chlorophyll-grains offer one of the most convincing demonstrations of this interesting point that I have thus far observed.

Here, as elsewhere, the green coloring-matter is not contained in the meshes of the structure, the meshes being the spaces formed and bounded by the threads or bands which together form the chromatophore, but is within those filaments themselves. The meshes, by the correct focus of the objective, are jet black.

A membrane also seems to surround the chlorophyll-grains of this variety of *Begonia*, but is not commonly visible, being demonstrable only with certain of the larger chromatophores.

In the young leaves of other varieties of the genus a similar structure is readily visible, but in the mature and in the old the appearance becomes obsolete. The change seems to begin early in the life of the chlorophyll-grain and to advance rapidly, the chromatophore soon becoming filled with starch. That the action of the light which augments the formation of the starch has any concomitant influence on the trabecular structure of the chromatophore itself I do not know.

This structure of the chlorophyll-grain is probably not uncommon.



Explanation of Figures.

FIG. 1. *Selaginella Krusiana;* chromatophores connected together by short, delicate threads of protoplasm. (After Haberlandt.)

FIG. 2. Chromatophore of *Astrophyllum sylvaticum* in optical section, showing the surrounding membrane between two dividing grains, with optic sections of the elevated ridges and of the black space between the body of the chromatophore and the membrane.

FIG. 3. Optical section of a chromatophore of *Astrophyllum* after treatment with alcohol and with eosin staining; showing the projecting elevations or ridges and the external membrane, the space between the body and the membrane being left white.

FIG. 4. Greatly enlarged view of the central portion of Fig. 2, showing dark spaces within the membrane between the dividing chromatophores; this part of the membrane is becoming double.

FIG. 5. Protoplasmic threads in the leaf-cells of *Astrophyllum sylvaticum*.

FIG. 6. Dividing chromatophores of *Ageratum conyzoides*, showing the pitted surface, the laterally projecting ridges (in optical section) and the central spaces between the dividing chromatophores. Diagram.

FIG. 7. Leaf-cell of *Astrophyllum*, showing nucleus, chromatophores and protoplasmic threads.

FIG. 8. Transverse vertical section of leaf-cells of *Astrophyllum*, showing chromatophores, nucleus and protoplasmic threads.

Proceedings of the Botanical Club, A. A. A. S., Brooklyn Meeting, August 15-22, 1894.

The meetings were held in the Packer Institute.

FRIDAY MORNING, AUGUST 17TH.

The meeting was called to order by Professor N. L. Britton, and in the absence of the President, Prof. D. H. Campbell, Prof. Geo. F. Atkinson was elected to the office of President.

Prof. F. C. Newcombe was elected to the Secretary's office in the absence of Mr. W. T. Swingle.

The report of the Secretary was read, showing for the year ending Aug. 14, 1894, receipts to the amount of $8, and an equal amount of disbursements. The report was accepted. Voluntary contributions to the amount of $7.32 were made by those present.

Prof. C. E. Bessey then gave some notes on the germination of macrospores of *Marsilia vestita*. These were germinated in water, forming larger prothallia with rhizoids than are usually present in this genus.

Dr. Erwin F. Smith recommended the preliminary treatment of vegetable sections with tannin solution, in order by subsequent staining to differentiate micro-organisms present in the tissues.

Prof. F. C. Newcombe also spoke favorably of tannin solution as aiding in the differentiation of protoplasmic structure by subsequent staining.

Dr. W. J. Beal showed how measurements of parts may be helpful in the identification of grasses.

Prof. L. R. Jones reported that the raising of oats in Vermont imported from localities affected with smut tended to decrease the percentage of the disease.

Prof. N. L. Britton thought that the return of the oat to its native environment—that being probably similar to the conditions in Vermont—might cause a reversion to its original healthy growth.

Prof. B. T. Galloway was inclined to ascribe the decrease of smut in Vermont to conditions unfavorable to the germination of the sporidia.

Prof. B. T. Galloway, Dr. E. F. Smith and Mr. G. H. Hicks reported on the use of formaline as a preserving fluid, stating that in a 1 per cent. solution it is cheaper than alcohol, and for a period of several months, while it has been in use, it has preserved the colors of persistent leaves, fleshy fungi, and fruits much better than alcohol.

Prof. J. M. Coulter then called for the report of the Committee charged with the preparation of a check-list of Northeastern American plants.

Prof. N. L. Britton, Chairman of the Committee, reported that about two-thirds of the list was already printed and that the remainder would be printed as soon as possible. The delay in completing the project was due to the great amount of time required in verifying references. The Editor of the Torrey Botanical Club had offered to print the list as one of its MEMOIRS, and the offer had been accepted by the Committee as the most practicable means that had presented itself. The regular price of the MEMOIRS is $3.00 per volume, but this volume would be given to subscribers to a list now before the Club for $1.00. After the subscribers had been supplied the price would be raised to $3.00. The subscription list would be kept open until the work is issued. The report was accepted and the committee continued to complete the check-list.

Prof. C. E. Bessey suggested a board or cloth binding. Dr. Britton stated that the volume would consist of about 400 printed pages and bound in cloth would cost about $1.25 to subscribers. After considerable discussion it was finally understood that subscribers were to have a choice of bound and unbound copies, the unbound to cost $1.00 and the bound $1.25.

FRIDAY AFTERNOON, AUGUST 17TH.

Dr. E. F. Smith in the Chair.

Dr. Smith then presented "Additional Notes on the bacterial Disease of Cucumbers, with an Exhibit of Photomicrographs." The cause of the disease lies in the filling of the vessels by the growth in them of bacteria, thus stopping the flow of water.

Prof. C. E. Bessey spoke on "Extreme Decapitalization," in nomenclature, suggesting that the Club might do good by sending to publishers who violate usage a statement of accepted practice. Prof. B. T. Galloway moved that a committee of three be appointed to take the matter under consideration. The motion was carried, and the Chair announced that he would name the committee later.

Prof. L. R. Jones recommended a form of *Hæmatococcus* for class demonstration of motile gametes.

The same speaker exhibited a method of showing leaves between glass plates to classes of students.

MONDAY MORNING, AUGUST 20TH.

The meeting was called to order by the President, who announced Mr. Elias J. Durand to speak on "Sporangial Trichomes in certain Ferns."

Trichomes occur more or less abundantly on the sporangia of certain ferns, especially those of the genera *Phegopteris* and *Polypodium*. The occurrence is constant and not accidental. In the instances already observed these hairs, which are either acute or capitate, are always found on the lateral wall of the sporangium near the annulus. So far as noted trichomes occur on the sporangia of such ferns only as have similar ones on the surface of the frond. The occurrence of trichomes on sporangia is consistent with the known epidermal nature of the latter. The function of sporangial hairs may be protective, as they occur most abundantly on non-indusiate ferns.

Mr. Arthur Hollick spoke on "Stipules and their Significance from the Standpoint of Palæobotany."

The material upon which these remarks is based was collected from the Laramie horizon near Walsenberg, Colo., for the late Prof. J. S. Newberry, but was not described by him. The geo-

logical side of the subject was discussed in a paper read before Section E, but some points of biologic interest it was thought best to present before the Botanical Club in an informal way.

The specimens in question represent a new fossil species of *Liriodendron*, which is unique inasmuch as the petioles of the leaves are bordered by wing-like appendages, a quarter of an inch or more in width. Similar appendages are known in other genera, and it is a matter of importance to know just what they represent.

Platanus occidentalis shows basilar expansions of its leaves extending down the petioles, besides conspicuous foliaceous stipules at the base of the petioles. The significance of these has been shown by Prof. Lester F. Ward in his "Palæontologic History of the Genus *Platanus*,"* in which he advocates the theory that the stipular appendages represent portions of the lower part of the leaf-blades which have become separated and crowded down the petiole.

With this new species of *Liriodendron* we are apparently now in a position to treat this genus in the same manner and to consider the conspicuous stipules which are on the young branches, but soon disappear, as possibly the ultimate development of the wing-like appendages along the petioles of our Laramie fossil, which in turn may be merely separated portions of the bases of the leaf blades. This interpretation involves the whole question of the importance and significance of stipules in general and what they really represent in the living flora. The remarks were illustrated by drawings of fossil species of *Liriodendron* and *Platanus* and mounted specimens of *L. Tulipifera* and *P. occidentalis*.

Prof. C. R. Barnes communicated the fact that the sporophyte stage of *Bryoziphium* (*Eustichium*) *Norvegicum*, found ten years or more ago in Wisconsin by Mrs. E. G. Britton, and which had not been reported since, were collected in great quantities the present summer by Mr. Cheney. It seems certain that this moss does not often fruit.

Mr. J. J. Davis reported *Entyloma Flœrkeæ* as forming its chains of gonidia in a broken instead of in a straight line.

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* Proc. U. S. Nat. Mus. 11: 39–42.

TUESDAY MORNING, AUGUST 21ST.

Prof. B. D. Halsted exhibited photographs of variegated leaves made by the Solandi method, the description of the same having been published in a former number of the BULLETIN.

Prof. C. E. Bessey spoke for "A better Pronunciation of botanical Terms." After citing examples of inconsistent pronunciation, the speaker suggested Percey Miles' essay written for Nicholson's Gardener's Dictionary as a guide, *i. e.* the adoption of the Roman method of pronunciation, although it is consistency that is desirable rather than any particular method. Prof. N. L. Britton moved that a standing committee on pronunciation be appointed, the members to be named by the President. The motion was carried.

Prof. B. D. Halsted spoke briefly on "The Peach-spotting Fungus as a Leaf-parasite," stating that the fungus effects numerous perforations in the peach leaves.

Mr. E. J. Durand presented notes on "The Development of *Olpidium* sp., one of the Chytridiaceæ." This plant is parasitic on *Spirogyra*. The uniciliated zoospores work their way into the interior of the algal cell, where they grow in size and acquire a wall as the sporangium. The cell of the host is much swollen by the sporangium or several sporangia which occur within it. When the fungus approaches maturity a tube is given out from one side of the sporangium which extends to some distance outside the cell of the host, at the same time the protoplasm of the fungus becomes divided up into ciliated zoospores which finally escape through the tube by the rupture of its apex.

Prof. B. D. Halsted exhibited leaves of *Pæonia* discolored by some disease whose cause he had ascertained to be not from insects. He asked for suggestions from anyone as to its cause.

Dr. E. F. Smith explained a method for making pure cultures of fungi. The method consists in the usual distribution of spores in agar or gelatine to be poured subsequently into a Petrie dish. When the gelatine has become solid, the dish is inverted on the stage of a microscope, a single spore found and surrounded by a ring of ink on the bottom of the dish. The disk of gelatine is then cut out, put into another dish and fresh nutrient solution

poured over it. In this way the development of a single spore may be easily followed.

The President made an announcement of the organization of the Botanical Society of America, stating that the charter members selected by the Club at the Madison meeting had organized in Brooklyn by electing Prof. Wm. Trelease, President; Prof. N. L. Britton, Vice-President; Mr. John Donnell Smith, Treasurer, and Prof. C. R. Barnes, Secretary.

The committee appointed to nominate officers of the Club for next year reported as follows:

For President—Douglas H. Campbell, of Leland Stanford, Jr., University.

For Secretary—Frederick C. Newcombe, of Michigan University.

Signed, B. T. GALLOWAY,
G. H. HICKS,
E. J. DURAND,
Committee.

The report of the committee was accepted and adopted.

Prof. C. E. Bessey and Mr. Roscoe Pound explained the work of the Botanical Seminar in making a survey of the flora of Nebraska, and exhibited advance sheets of Parts I. and II. of the Flora of Nebraska.

Mr. M. B. Waite spoke of the killing of young shoots of the pear by excessive transpiration. The same speaker also offered suggestions on the staining of the flagellæ of bacteria.

Profs. Galloway, Bessey and Coville were named as the committee to prepare a statement for the convenience of publishers, that errors in the use of capitals in nomenclature might be avoided.

The Club then adjourned to meet at the assembling of the A. A. A. S. next year.

FREDERICK C. NEWCOMBE,
Secretary.

Organization of the Botanical Society of America.

Pursuant to a call issued by the committee appointed from the original members of the new national association of botanists, a meeting for organization was held at Brooklyn, N. Y., on August

15th, 1894, and continued on several succeeding days, eleven members being present. The committee submitted a draft of a constitution, which, after some modification, was adopted, and the society organized by the election of the following officers: President, Wm. Trelease; Vice-President, N. L. Britton; Treasurer, John Donnell Smith; Secretary, Chas. R. Barnes. Among the provisions of the constitution the following are of general interest:

Only American botanists engaged in research, who have published works of recognized merit, shall be eligible to active membership. Candidates for active membership shall be recommended by three active members of the society, not members of the council, who shall certify that the candidate is eligible under the provisions of the constitution. The officers, together with the last past President, and two members elected by the society at its annual meeting, shall constitute a council, which shall be charged with such duties as are prescribed by the society and shall represent it in the intervals between meetings. The society shall hold an annual meeting at such time and place as the council may select, and special meetings for the presentation of papers or the transaction of business at such other times and places as the society or council may from time to time deem necessary.

Titles of Botanical Papers presented before the Section of Botany, A. A. A. S., Brooklyn Meeting, August 16-23, 1894.

In the absence of Prof. Lucien M. Underwood, Vice-president of the Section, Prof. C. E. Bessey, Vice-president for the preceding year was requested to retain the chair. Prof. Underwood's address, "The Evolution of the Hepaticæ," was read by Dr. S. Ely Jelliffe.

The papers read during the sessions were as follows:

"The Growth of Radishes as affected by the Size and Weight of the Seed," by B. T. Galloway.

"The Work of the Indiana Biological Survey," By A. W. Butler.

"The Movement of Gases in Rhizomes," by Katherine E. Golden.

"Some interesting Conditions in Wood resulting from the Attacks of Insects and Woodpeckers," by A. D. Hopkins.

"The Sugar Maples of Central Michigan," by W. J. Beal.

"Some Affinities among Cactaceæ," by John M. Coulter.

"Simplification and Degeneration," by Charles E. Bessey.

"Regulatory Growth of Mechanical Tissue," by Frederick C. Newcombe.

"Further Studies in the Relationship and Arrangement of the Flowering Plants," by Charles E. Bessey.

"Relation of Age of Type to Variability," by L. H. Bailey.

"Limits of Biological Experiments," by Manly Miles.

"The Struggle for Existence under Cultivation," by L. H. Bailey.

"Relation between the Functions of the vegetative and reproductive Leaves of *Onoclea*," by George F. Atkinson.

"*Lophotopappus*, a new Genus of Mutisiaceous Compositæ, and *Fluckigeria*, a new Genus of Gesneriaceæ," by H. H. Rusby.

"On the Swarm Spores of *Pythium* and *Ceratiomyxa*," by George F. Atkinson.

"A Revision of the Genus *Scouleria*," by Elizabeth G. Britton.

"Evidence as to the former Existence of large Trees on Nantucket Island," by Burt G. Wilder.

"Notes on the Primary Foliage and the Leaf-Scars in *Pinus rigida*, by N. L. Britton.

"Notes upon *Chalara paradoxa*," by Byron D. Halsted.

"A Hybrid among the Mosses," by Elizazeth G. Britton.

"Notes upon the Root Rot of Beets," by Byron D. Halsted.

"On *Torreya* as a generic Name," by N. L. Britton.

"Some notes on the Genus *Encalpyta*," by Elizabeth G. Britton.

"Species of *Taphrina* parasitic on *Populus*," by Mrs. F. W. Patterson.

Prof. J. C. Arthur was elected Vice-President of the Section for the next meeting, and Mr. B. T. Galloway, Secretary.

Report of the Committee on Bibliography of the Madison Botanical Congress.

To Section G, A. A. A. S.:

The committee on bibliography appointed by the Madison Botanical Congress was directed to report to Section G of the American Association for the Advancement of Science. This Section, therefore, is asked to receive the following report and take such action thereupon as seems wise:

The committee report that progress has been made during the past year in carrying out the suggestions made to the Madison Botanical Congress.* The first recommendation thereto made, viz.: "That there should be published a catalogue of papers [relating to American botany] by authors," has been undertaken and so far as it has gone has been successfully accomplished by the coöperation of a number of botanists with the editors of the BULLETIN of the Torrey Botanical Club and the Cambridge Botanical Supply Co. This index, printed first in the BULLETIN, is reprinted upon standard cards by the Cambridge Botanical Supply Co., so that any number of copies can be had and arranged by subjects or by journals as desired. Every effort will be made by those charged with the preparation of this index and its first publication to make it complete, and to have it conform exactly to the rules of citation prepared by this committee. The work of publication upon cards, however, is not adequately supported. The committee sincerely hope that this form of publication will not have to be given up, and they therefore urge that those interested testify their interest by sending their subscriptions to the Cambridge Botanical Supply Co., Cambridge, Mass.

The committee also announce that the BOTANICAL GAZETTE, in connection with the Cambridge Botanical Supply Co., is ready to undertake the publication of the supplementary list of journals referred to in section *1. b.* of the committee's report† to the Congress which appointed it. The publication of these lists of journals upon cards will be begun as soon as subscribers sufficient to

* Proc. Madison Bot. Congress, 45. Je. 1894.

† Loc. cit.

defray the expense of printing the cards can be secured. In the same way the BULLETIN of the Torrey Botanical Club will undertake the publication of the list of authors referred to in the committee's report under *l. c.* If the number of subscribers to the index of papers above mentioned as in course of publication can be immediately increased, these author cards will, for the present year, be sent free to subscribers.

The committee again call attention to the index of new genera and species of plants now being issued on cards by Miss Josephine E. Clark of Washington, D. C., and commend this to the support of botanists. Regarding this private publication they beg to suggest (1) that there be added to these cards such marks as will serve to identify the series when distributed in other indexes; (2) that in the interest of completeness *all* new names relating to North American plants be included.

A year's experience in the working of the rules for citations approved by the Madison Congress has not shown the necessity or desirability of any changes. To those rules, however, the committee desire to add the following amplifications:

In *f.* p. 46, l. c., before the last sentence insert: In case the original paging is unknown an em dash should occupy its place, the reprint paging being given in accordance with the foregoing rule.

The committee also recommend the adoption of the two following paragraphs as addenda:

j. If it is considered desirable to give other data than series number (if any), volume number, page and date, these should be added in brackets after the date. But useless or unnecessary data should be avoided.

k. Citations of reviews, abstracts and all such secondary references should be enclosed in parentheses.

Since uniformity is the chief object in the adoption of the rules for citation by the Congress, the committee call attention to the necessity of an exact following of these rules by as many writers and publishers as can be induced to give adhesion to them. To facilitate this we recommend that the editors of the BULLETIN of the Torrey Botanical Club, the BOTANICAL GAZETTE, ERYTHEA and the AMERICAN NATURALIST be requested to publish these

rules and examples of as great a variety of citations as practicable. The committee also desire to issue these on tag-board sheets in a form which can be readily distributed and preserved for convenient reference. To enable the committee to do this, and to disseminate information upon these points, we recommend that the Council of the A. A. A. S. be requested to make a grant of $25 to cover the necessary expenses which may be incurred.

Index to Recent Literature relating to American Botany.

Atkinson, G. F. Notes on some Exoasceæ of the United States. Bull. Torr. Bot. Club, **21**: 372–380. 20 Au. 1894.

Bay, J. Christian. Crystals of Ice on Plants. Bot. Gaz. **19**: 321–326. 15 Au. 1894.

Britton, E. G. Contributions to American Bryology—VIII. Bull. Torr. Bot. Club, **21**: 343–372, *pl.* 213–217. 20 Au. 1894.

A revision of the genus *Bruchia* with descriptions of types, and one new species. Figures *B. Texana*, *B. Donnellii*, *B. Hallii*, *B. fusca* and *B. Carolinæ*.

Davy, J. B. Transcripts of some Descriptions of California Genera and Species. Erythea, **2**: 136–140. 1 Au. 1894.

Dawson, J. W. On new Species of Cretaceous Plants from Vancouver Island. Trans. Roy. Soc. Canada, **11**: **Sec. iv**: 53–73, *pl. 5–14*. 1894.

Deane, W. An abnormal *Hepatica*. Bot. Gaz. **19**: 338. 15 Au. 1894.

Dietel, P. Descriptions of new Species of Uredineæ and Ustilagineæ, with Remarks on some other Species. Bot. Gaz. **19**: 303–306, *pl. 29*. 15 Au. 1894.

Figures and describes *Puccinia areolata*, *P. Treleasiana*, *P. Zoppii*, *P. Calthæ* and *Tolyposporium Davidsonii*.

Dietel, P. New California Uredineæ—II. Erythea, **2**: 127–129. 1 Au. 1894.

Describes *Uredo læviuscula* D. & H., *U. Pteridis* D. & H., *Puccinia McClatchieana* D. & H., *P. recondita* D. & H., and *P. palefaciens* D. & H.

Fernald, M. L. Northwestern Notes. Bot. Gaz. **19**: 35, 36. 15 Au. 1894.

Describes *Lathyrus pauciflorus*, *Rosa Nutkana hispida*, and *Calochortus pavonaceus* as new.

Harshberger, J. W. James Logan, an early Contributor to the Doctrine of Sex in Plants. Bot. Gaz. **19**: 307–312. 15 Au. 1894.

Hay, G. U. The Flora of New Brunswick. Trans. Roy. Soc. Canada, **11**: **Sec. iv.**: 45–50. 1894.

Hicks, G. H. Anatomical and Physiological Researches. Bot. Gaz. **19**: 327–330. 15 Au. 1894.

Nourishment of the embryo and importance of the endosperm in viviparous mangrove plants.

Howe, M. A. Chapters in the early History of Hepaticology—I. Erythea, **2**: 130–135. 1 Au. 1894.

Knowlton, F. H. Fossil Flora of Alaska. Bull. Geol. Soc. Am. **5**: 573–590. 1893. Also under title, A Review of the Fossil Flora of Alaska, with Descriptions of New Species. Proc. U. S. Nat. Mus. **17**: 207–240, *pl. 9*. 1894.

Knowlton, F. H. Fossil Plants as an Aid to Geology. Journ. Geol. **2**: 365–382. My–Je. 1894.

MacDougal, D. T. Anatomical and Physiological Researches. Bot. Gaz. **19**: 331–332. 15 Au. 1894.

A contribution to the physiology of the genus *Cuscuta*.

Owen, M. L. *Trillium cernuum*. Bot. Gaz. **19**: 337–338. 15 Au. 1894.

Pammel, L. H. Prickly Lettuce and some other Weeds in Iowa. Gard. & For. **7**: 358. 5 S. 1894.

Rand, E. L. and **Redfield, J. H.** Flora of Mount Desert Island, Maine. A Preliminary Catalogue of Plants growing on Mount Desert and the adjacent Islands. 8vo. pp. 286. Cambridge, 1894.

Reed, M. Cross-fertilization of *Petunias*. Bot. Gaz. **19**: 336–337. 15 Au. 1894.

Rose, J. W. Some Notes on Tree *Ipomœas* of Mexico. Gard. & For. **7**: 366, *f. 58, 59*. 12 S. 1894.

Notes on *Ipomœa fistulosa*, *I. muricoides*, and descriptions of two new species *I. intrapilosa* and *I. Wolcottiana*.

Sargent, C. S., Editor. *Cereus Pecten-aboriginum*. Gard. & For. **7**: 334, *f. 54*. 22 Au. 1894.

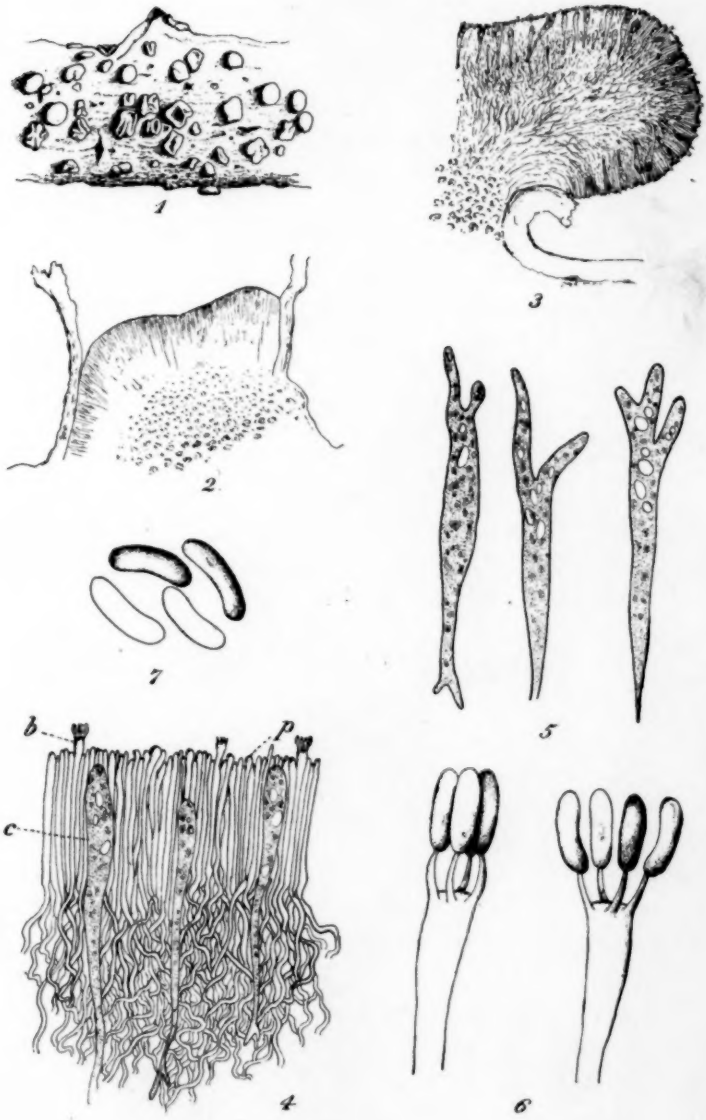
Sargent, F. LeRoy. Barberries. Pop. Sci. Month. **45**: 594–608; 784–795, *figs*. 1894.

Stone, G. E. Germinating Seeds in Saw-dust. Bot. Gaz. **19**: 333, 334. 15 Au. 1894.

Sturtevant, E. L. Notes on Maize. Bull. Torr. Bot. Club, **21**: 319–343. 20 Au. 1894.

Tilden, J. E. Notes on the Development of a filamentous Form of *Protococcus* in Entomostracan Appendages. Bot. Gaz. **19**: 334, 335, *pl. 30.* 15 Au. 1894.

Uline, E. B. and **Bray, W. I.** A preliminary Synopsis of the North American Species of *Amaranthus*. Bot. Gaz. **9**: 267–272. 16 Jy. 313–320. 15 Au. 1894.



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